AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A system for classifying packets, wherein each packet has N header fields to be used for processing, the system comprising:

a first set of rules associating to the packets by values of the header fields; and

a classification system for selecting specific rules in the set of rules as applicable to a specific packet;

characterized in that the classification system projects the first set of rules as N-dimensional entities on N axes in N-dimensional space, marking the beginning and ending value on each axis for each rule as a breakpoint, ~~assigns a~~ assigns one of a sequence of binary interval numbers to each interval between breakpoints such that all adjacent intervals are numbered in ascending sequential binary order and such that each of the binary interval numbers has a number of bits that is less bits than the number of bits for axis values corresponding to the breakpoints, associates a subset of the first set of rules applicable in each interval to the ~~assigned~~ binary interval number of the appropriate interval between breakpoints on each axis, then considers a packet as a point in the N-dimensional space according to its header field values, locates the binary interval number assigned to the interval into which the point projects on each axis by performing a search on each axis for the ~~numbered~~ interval into which the point projects on that axis, thereby determining rules applicable to the packet from the subsets of rules by selecting those rules as applicable to the packet that apply to the packet on all of the N axes.

2. (Currently Amended) The system ~~of claim 1~~as recited in claim 1, wherein the search performed on each axis is a binary search conducted by selecting breakpoints at which the bits change for the ~~binary numbered intervals~~binary interval numbers.

3. (Currently Amended) The system ~~of claim 1~~as recited in claim 1, wherein the search performed on each axis is a quaternary or higher-level M-ary search, where M is a power of 2, conducted by selecting breakpoints at which the bits change for the binary ~~numbered intervals~~interval numbers.

4. (Currently Amended) The system ~~of claim 1~~as recited in claim 1, wherein association of applicable rules in the each ~~numbered~~ interval is made by associating a binary string with the each interval, with one bit dedicated to each rule.

5. (Currently Amended) The system ~~of claim 4~~ as recited in claim 4, wherein rules are associated to bit positions in the binary string by priority, the order of priority according to bit significance, and a final rule is selected by the most significant 1 in the matching rules.

6. (Currently Amended) The system ~~of claim 4~~as recited in claim 4, wherein the applicable rules are found by ANDing the binary strings determined for each axis over all axes.

7 (Currently Amended) The system ~~of claim 1~~as recited in claim 1, comprising at least one hardware pipeline for conducting the search on an axis, the pipeline comprising first, second, and sequential modules for accomplishing increasingly particular portions of the search, wherein, after the first module of the sequential modules is used, determined values from the first module pass to the second module, and values for a second packet enter the pipeline at the first module, the pipeline operations proceeding thus sequentially.

8. (Currently Amended) The system ~~of claim 7~~as recited in claim 7, comprising parallel pipelines with one pipeline dedicated to searching on each axis in the N-dimensional space, wherein searches are conducted for applicable intervals simultaneously on each axis.

9. (Currently Amended) The system ~~of claim 8~~as recited in claim 8, wherein applicable rules for the each interval on each axis are represented by individual bitmaps, with each rule assigned a bit position, and wherein the outputs of the parallel pipelines, being the ~~numbered~~ interval on each axis into which the point for a packet projects, are exchanged for the associated bitmaps, which are then ANDed to determine the applicable rules.

10. (Currently Amended) The system ~~of claim 1~~as recited in claim 1, wherein searching is interleaved, and wherein results of searching on one or more axes ~~being~~ is applied to other axes before searching on the other axes.

11. (Currently Amended) The system ~~of claim 10~~as recited in claim 10, wherein rules that are found by search to not apply on one or more axes are not considered in searches conducted on other axes.

12. (Currently Amended) A method for classifying packets in routing, wherein each packet has N fields to be used in processing in a header, comprising ~~the steps of~~:

~~(a) projecting~~projecting the rules as N-dimensional entities on N axes in N-dimensional space;

~~(b) marking~~marking the beginning and ending value on ~~each axis~~each of the N axes for each rule as a breakpoint;

~~(c) assigning a~~assigning one of a sequence of binary interval numbers to each intervals between breakpoints on ~~each axis~~the each of the N axes such that all adjacent intervals are numbered sequentially in ascending binary order, wherein each of the binary interval numbers has a number of bits less than the number of bits for axis values corresponding to the breakpoints;

~~(d) identifying~~identifying those of the breakpoints at which bits in the binary interval numbers change;

~~(e) associating~~associating a subset of the rules as applicable ~~in to the~~to the one of the sequence of binary interval numbers~~assigned number of~~ for the each interval on each axis;

~~(f) considering~~considering a packet as a point in the N-dimensional space according to the values of the header fields for the packet;

~~(g) determining~~determining by ~~search the~~ search a particular binary interval number ~~of the~~ corresponding to a particular interval on each axis into which the packet point projects;

~~(h) substituting~~substituting the subset of rules that apply for ~~each determined~~ the particular interval for the each axis; and

~~(i) selecting~~selecting those rules as applicable to the packet that associate to the packet on all of the N axes.

13. (Currently Amended) The method ~~of claim 10~~as recited in claim 12, wherein~~, in step (g) the determination~~ the determining ~~is made by~~ comprises performing a binary search.

14. (Currently Amended) The method ~~of claim 12~~as recited in claim 12, wherein~~, in step (g), the determination~~ the determining comprises performing~~is made by~~ a quaternary or higher-level M-ary search.

15. (Currently Amended) The method ~~of claim 12~~as recited in claim 12 wherein~~, in step (e), association~~ the associating of applicable rules ~~in each numbered interval~~to the one of the sequence of binary interval numbers comprises ~~is made by~~ associating a binary string with each interval, with one bit dedicated to each rule.

16. (Currently Amended) The method ~~of claim 15~~as recited in claim 15, wherein the rules are mapped to bit positions in the binary string by priority, the order of priority according to bit significance, and a final rule is selected by the most significant 1 in the matching rules.

17. (Currently Amended) The method ~~of claim 15~~as recited in claim 15, wherein~~, in step (i),~~ the selecting comprises ~~the matching rules are found by~~ ANDing the binary strings determined for each axis over all axes to determine those rules applicable to the packet.

18. (Currently Amended) The method ~~of claim 12~~as recited in claim 12, wherein~~, in step (g),~~ the determining comprises conducting the search ~~is conducted~~ by sequential modules in at least one hardware pipeline, the pipeline comprising first, second, and sequential modules for accomplishing increasingly particular portions of the search, and wherein, after the first module of the sequential modules is used, determined values from the first module pass to the second module, and values for a second packet enter the pipeline at the first module, the pipeline operations proceeding thus sequentially.

19. (Currently Amended) The method ~~of claim 17~~as recited in claim 17, wherein the determining comprises~~ing~~ employing parallel pipelines with one pipeline dedicated to searching on each axis in the N-dimensional space, and wherein searches are conducted for applicable interval simultaneously on each axis.

20. (Currently Amended) The method ~~of claim 19~~as recited in claim 19, wherein applicable rules for each interval on each axis are represented by individual bitmaps, with each rule assigned a bit position, and wherein the outputs of the parallel pipeline, being the numbered interval on each axis into which the point for a packet projects, are exchanged for the associated bitmaps, which are then ANDed to determine the second set of matching rules.

21. (Currently Amended) The method ~~of claim 12~~as recited in claim 12 wherein~~, in step (g)~~ the determining comprises an ~~searching is~~ interleaved search, and wherein results of searching on one or more axes ~~being applied~~ are applied to other axes before searching on the other axes.

22. (Currently Amended) The method ~~of claim 21~~ as recited in claim 21, wherein rules that are found by search to not apply on one or more axes are not considered in searches conducted on the other axes.

23. (Currently Amended) In a system for classifying packets by binary or higher-level searching for intervals into which rules project on axes, a method for simplifying a search, comprising~~ the steps of~~:

projecting the rules as N-dimensional entities on N axes in N-dimensional space;

marking the beginning and ending value on each of the N axes for each rule as a breakpoint;

assigning one of a sequence of binary interval numbers to each interval between breakpoints on the each of the N axes such that all adjacent intervals are numbered sequentially in ascending binary order, wherein each of the binary interval numbers has a number of bits less than the number of bits for axis values corresponding to the breakpoints;

identifying those of the breakpoints at which bits in the binary interval numbers change;

conducting~~(a) conducting~~ a first search on one or more axes; and

using ~~(b) using~~ information from the first search to simplify further searching on remaining axes.